Designing quality inspection in short-run assembly processes of wrapping machines

BOOK OF ABSTRACTS

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Abstract:

According to difficulties in using quality management information in design process and lack of mutual understanding among designers, a digital design quality management method using informationized technology was developed, combining with design quality management practices in the author's institute recent years, to improve the transparency and availability of management process information and the influence of organizational system, as well as the awareness of self-improvement for designers.

Designing quality inspection in short-run assembly processes of wrapping machines

– *Elisa Verna, Politecnico di Torino [ITALY]*

Abstract:

Manufacturing companies are increasingly focused on producing high-quality, fault-free products that meet customer needs. From this perspective, designing inspection procedures that are effective in detecting defects occurring in different stages of production has always been a great challenge and a pivotal factor in being competitive in the market. Studies in the electromechanical field have shown that defects caused by operators during assembly operations can be predicted through specific conditioning factors relying on process and design complexity, and human behaviour. Recently, these defect prediction models have been used to obtain reliable a priori estimates of defect occurrence probabilities in short-run assembly manufacturing processes, for which traditional statistical process control (SPC) techniques are not appropriate. The research here presented investigates, for the first time, the development of a specific probabilistic model of defect generation for assembly processes of wrapping machines, and its subsequent use for designing effective and affordable inspection strategies. The production of wrapping machines can be classified as a short-run assembly process due to the high degree of customization, to such an extent that each machine may be considered almost unique. Accordingly, the planning of product quality inspections represents a remarkable problem in this industrial sector. In this view, this study aims at (i) identifying a relationship between process or design complexities and the generation of defects in the assembly processes of wrapping machines, and (ii) determining how the knowledge of the defects possibly occurring in the process can influence the design of inspection strategies. The study focuses on the assembly of a specific part of a wrapping machine: the pre-stretching device. In a first phase of the research, basing on experimental data, a prediction model relating the observed defects number in each workstation and complexity factors was investigated. The obtained results showed that the exponential behaviour of the model is confirmed also for wrapping machines, in agreement with what is reported in the scientific literature for other manufacturing sectors. Consequently, the prediction model can be used to obtain reliable estimates of the probability of occurrence of defective-workstation-output in each workstation. Basing on these probabilities, a second step of the research led to the definition of a probabilistic model aimed at the assessment of the effectiveness and cost of quality inspection. The proposed methodology plays a key role not only in the early design stage of new quality inspections for the assembly of new devices or new wrapping machines, but also in improving existing inspection strategies. In fact, through the use of the two indicators of effectiveness and affordability, the most critical workstations can be easily detected. As a result, inspection engineers are driven to identify alternative control procedures in order to make the inspection strategy more effective and cost-efficient.

Kaizen System implementation

– *Balázs Németh, Kvalikon [HUNGARY]*